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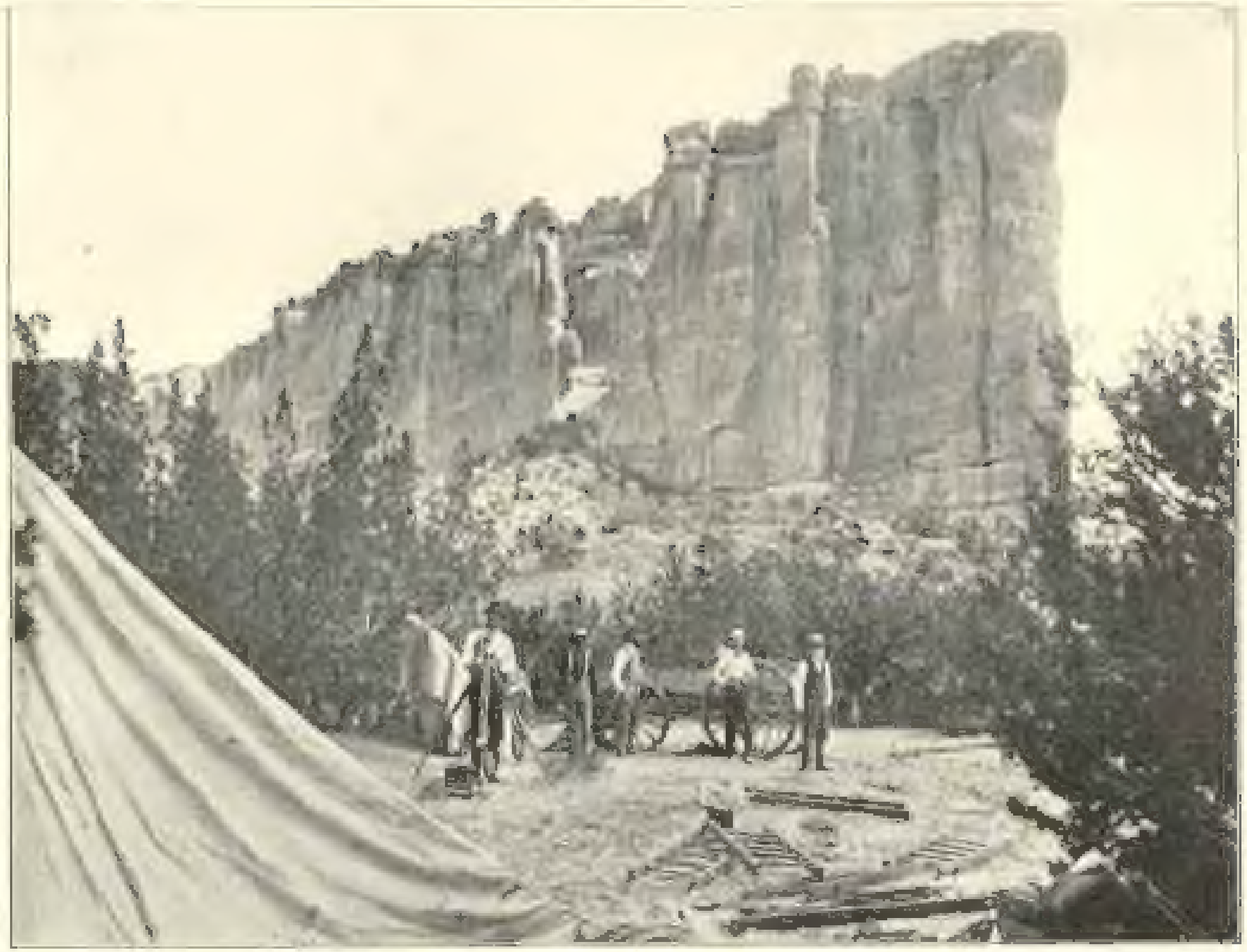

THE ENCHANTED MESA — THE GREAT SOUTHWESTERN CLIFF AND TALUS HEAP

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THE ENCHANTED MESA

By F. W. Hodge,
Bureau of American Ethnology

The pueblo of Acoma, in western central New Mexico, is the oldest settlement within the limits of our domain. Many of the walls that still stand on that beetling pedal were seen by Coronado during his marvelous journey in 1540, and even then they were centuries old.

The valley of Acoma has been described as "the Garden of the Gods multiplied by ten, and with ten equal but other wonders thrown in; plus a human interest, an archæological value, an atmosphere of romance and mystery;" and the comparison has not been overdrawn. Stretching away for miles lies a beautiful level plain clothed in grama and bound on every side by mesas of variegated sandstone rising precipitously from 300 to 400 feet, and relieved by minarets and pinnacles and domes and many other features of nature's architecture. About their bases miniature forests of piñon and cedar are found, pruned of their dead limbs by native wood-gatherers. Northwestward, Mount Taylor, the loftiest peak in New Mexico, rears its verdant head, and 20 miles away to the westward the great frowning pine-fringed Mesa Prieta, with the beautiful vale of Cebollita at its feet, forms a fitting foreground to every dying sun.

But none of these great rock-tables is so precipitous, so awe-inspiring, and seemingly so out of place as the majestic isolated Katzimo or Enchanted Mesa, which rises 430 feet from the middle of the plain as if too proud to keep company with its fellows; and this was one of the many wonderful homesites of the

Acomas during their wanderings from the mystic Shípápu in the far north to their present lofty dwelling place.

Native tradition, as distinguished from myth, when uninfluenced by Caucasian contact, may usually be relied on even to the extent of disproving or verifying that which purports to be historical testimony. The Acoma Indians have handed down from shaman to novitiate, from father to son, in true prescriptorial fashion for many generations, the story that Katzimo was once the home of their ancestors, but during a great convulsion of nature, at a time when most of the inhabitants were at work in their fields below, an immense rocky mass became freed from the friable wall of the cliff, destroying the only trail to the summit and leaving a few old women to perish on the inaccessible height. What more, then, could be necessary to enwrap the place forever after in the mystery of enchantment?

This tradition was recorded in its native purity some twelve years ago by Mr Charles F. Lummis, who has done so much to stimulate popular interest in this most interesting corner of our country, and the same story was repeated by Acoma lips to the present writer while conducting a reconnaissance of the pueblos in the autumn of 1896. During this visit, desiring to test the verity of the tradition, a trip was made to the base of Katzimo, where a careful examination of the talus (especially where it is piled high about the foot of the great southwestern cleft (Pl. 32, 33) up which the ancient pathway was reputed to have wound its course) was rewarded by the finding of numerous fragments of pottery of very ancient type, some of which were decorated in a vitreous glaze, an art now lost to Pueblo potters. The talus at this point rises to a height of 224 feet above the plain, and therefore slightly more than half-way up the mesa side. It is composed largely of earth, which could have been deposited there in no other way whatsoever than by washing from the summit during periods of storm through many centuries. An examination of the trail to a point within 60 feet of the top exhibited traces of what were evidently the hand and foot holes that had once aided in the ascent of the ancient trail, as at Acoma today. Even then the indications of the former occupancy of the Enchanted Mesa were regarded as sufficient and that another one of many native traditions had been verified by archeologic proof.

Enchanted Mesa has become celebrated during the last summer through the reports of the expedition of Prof. William Libbey, of Princeton, who, after several days of effort, succeeded in scal-

THE GREAT BANDELIER CLEFT OF THE MESA

Through this cleft the traditional trail passed, and distinct traces of it are to be seen on each side of the vertical Ramp to the right of the upper ladder

ing the height, in the latter part of July, by means of a life-saving equipment. It would seem that Professor Libbey neglected to search for relics in the talus, that he devoted no attention to the great southwestern cleft or cove up which the trail was reputed to have passed, and that after spending some three hours on the narrow southern extension of the mesa top, awaiting the arrival of a ladder from Acoma to conduct him across a fissure, he employed the remaining two hours in a reconnaissance of the wider and more interesting part of the height, finding nothing that would indicate even a former visit by human beings.*

While engaged in archeologic work in Arizona and later in Cebolleta valley in western central New Mexico, some 20 miles westward from Acoma pueblo, I was directed to visit Katzimo once more in order to determine what additional data of an archeological nature might be gathered by an examination of the summit. The knowledge gained by the previous visit made it apparent that a light equipment only would be necessary to accomplish the task. Procuring an extension ladder, comprising six 6-foot sections, some 300 feet of half-inch rope, and a pole-pick, together with a number of bolts, drills, etc., which afterward were found to be needless, I proceeded to Laguna, the newest, yet the most rapidly decaying, of all the pueblos, on the Santa Fé Pacific railroad. Here I was fortunate in enlisting the services of Major George H. Pradt, who has served as a United States deputy surveyor in that section for nearly 30 years; Mr A. C. Vroman, of Pasadena, California, a few of whose excellent photographs are here reproduced, and Mr H. C. Hayt, of Chicago. Much of the success of the little expedition is due to the untiring aid of these gentlemen, and for many creature comforts I am indebted to the Messrs Marmon, whose beautiful little home at Laguna has delighted the heart of many a weary wayfarer in that sunny land.

Leaving the railroad September 1, we proceeded with two farm wagons, each drawn by a very small black mule and a large white horse, driven by two sturdy Laguna boys. The road trends westward for about seven miles, then turns southward through a rather wide valley scarred with arroyas and lined with

* Had the explorer ascended to the northern part of the mesa by means of a bench a few feet below the summit of the rocky southern margin, it would not have been necessary for him to spend most of his time so fruitlessly in awaiting the arrival of friends to assist the ascent. The ladder was found as Professor Libbey had left it, but was taken down by one of the Indians, who followed the trail mentioned, in order to secure the rope for his own use. The ladder in the short one shown in Pl. 30, the photograph having been made during the descent.

fantastically carved sandstone cliffs. The summit of Mesa Encantada is visible for several miles ere the vale of Acoma is reached, and as one enters the valley proper he cannot fail to appreciate the wisdom displayed by the natives in the selection of the beautiful, grassy, mesa-dotted plain that has been their home for so many generations.

The next day was spent in the village witnessing that curious anomaly of paganism intermixed with christianity, known as the Fiesta de San Esteban. On the morning of the 3d an early start was made for Mesa Encantada, which lies three miles northwestward from the pueblo, just within the eastern boundary of the Acoma grant, in latitude 34° 54′ N., longitude 107° 34′ W.

The remainder of the forenoon was employed in making camp in the little grove of cedars at the base of the cleft near the southwestern corner of the height, in unpacking apparatus, and in determining the altitude of the mesa above the western plain. The observations of Major Pradt show that the elevation of the foot of the great talus slope above the plain is at this point 33 feet, the apex of the talus 254 feet above the plain, and the top of the highest pinnacle on the summit of the mesa overlooking the cleft 431 feet * above the same datum. (Pl. 22.)

The start from camp was made at noon. The ascent of the talus, in which the potsherds had been observed in such considerable quantities two years previously, was made in a few minutes, the ladders, ropes, and photographic and surveying instruments being carried with some effort, since climbing, heavily laden, at an altitude of 6,000 feet, in a broiling sun, is no trifling labor; but the real work began when the beginning of the rocky slope of the cleft was reached. One member of the party, taking the lead, dragged the end of a rope to a convenient landing place, where a dwarf piñon finds sufficient nourishment from the storm-water and sand from above to eke out a precarious existence. Fastening the rope to the tree, the outfit was hauled up, and the other members of the party found a ready means of ascent. The next landing was several feet above, at the base of a rather steep pitch of about twelve feet. This wall, although somewhat difficult to scale, may be climbed with greater or less safety by the aid of several small holes in its face. These holes were doubtless made artificially, but as the narrow pathway at this point is now a drain-

* These elevations were determined trigonometrically by means of an aneroid barometer, using a base-line of 100 feet measured opposite the cleft. The observations from the northern end of the base giving 431 feet and from the southern end 428 feet; mean, 431 feet.

against erosion during periods of storms, the softened [illegible] which descended that way have [illegible] recently lost their former slope. The cliff at this point was readily surmounted with the aid of two sections of the ladder, a rope being carried over the slope above and secured to a large boulder in the center of a commodious terrace some 60 feet below the summit.

This was the point which I reached during the 1895 visit. At that time I spent several minutes on this ledge, making diligent

finding none. This does not signify that none have ever existed, for both here and elsewhere about the cliffs great blocks of stone have fallen away so recently that their edges have not yet had time to round by erosion, and the now exposed faces of their former abiding places on the cliff wall are yet unstained by weathering. (See Fig. 1.)

The boulder previously alluded to rests in a corner of the ter-

I well remember hearing the chasm which section cut it. I [illegible]

of four oak sticks, large because the boulder, that I am sure were [illegible] there I swung my precious climb. They were about 24 feet so [illegible] long, and [illegible] thick, and had been freshly pointed at each end with a sharp tool, evidently a hatchet. Their occurrence here

[illegible] time [illegible] only my close examination. No similar, indeed, [illegible] stick afforded any indication of the former use of the [illegible], it

[illegible] means of scaling the wall in ancient times. I therefore concluded that the sticks had recently been left there by one who

[illegible]

[illegible] new impression after Mr Hayt dug from the moist sand at the

[illegible]

difficulty in discovering the ore. As an indication of the greater [illegible] between modern Acoma and Zuñi ward, for example, and

[illegible]

before us. Selecting the middle of the eastern face of the cove as the most convenient and least hazardous point of ascent, two

it reached the lower part of the sloping terrace above. Two

[illegible]

[illegible]
sible; yet it swayed and creaked and bent like a reed until the top was reached, and it required no little care to step from an [illegible] from its insecure bearing. The shelf was gained in safety, however; the rope was tied in a ring and made fast around a large block of stone on the terrace to the left. The others ascended one by one, each with the rope tied around his chest and drawn about the rock by the leader as a measure of precaution. Then the equipage, wrapped in blankets, was fastened to the end of a rope thrown to the two Indians below and drawn up piece by [illegible]
The time consumed by the entire climb was somewhat over two hours.

If the view from the valley at Acoma be beautiful, that from the summit of Katzimo is sublime. Mesa Prieta was still in [illegible]
the plains beyond. [illegible] peaks, born of the storm the [illegible]
clouds that festooned the northern horizon.

The summit of Katzimo has been swept and carved and swept again by the winds and rains of centuries since the ances- [illegible]
The walls of the dwellings, undoubtedly of the sun-baked mud-adobe that [illegible] must have been erected on the soil stratum, for the native finds an earth when he has it a [illegible]

The day before was a day of storm; it even rained and [illegible]
in a few "pot-holes" eroded in the sandstone. The water that [illegible]
of the storm's destructive work in detritus and about the base as in every storm for untold ages.

There is little wonder, then, that I despaired of [illegible] even

[illegible]

[illegible]

[illegible] that it may have found its [illegible] I think it will appear to have been [illegible] pile could not have been erected save by the hand of man. [illegible] It would have been impossible [illegible]

[illegible]

[illegible]

these Acomas among us. They were scarcely friendly at first, indeed, according to the story of our two Laguna men who lay upon the rug in the camp below, they had sent our first visitors back with the avowed intention of compelling us to descend, even if they had to threaten to cut down our ladder. A little explanation, however, coupled with the information that we had no [illegible] tobacco or sugar in stores beyond the camp fire, [illegible]

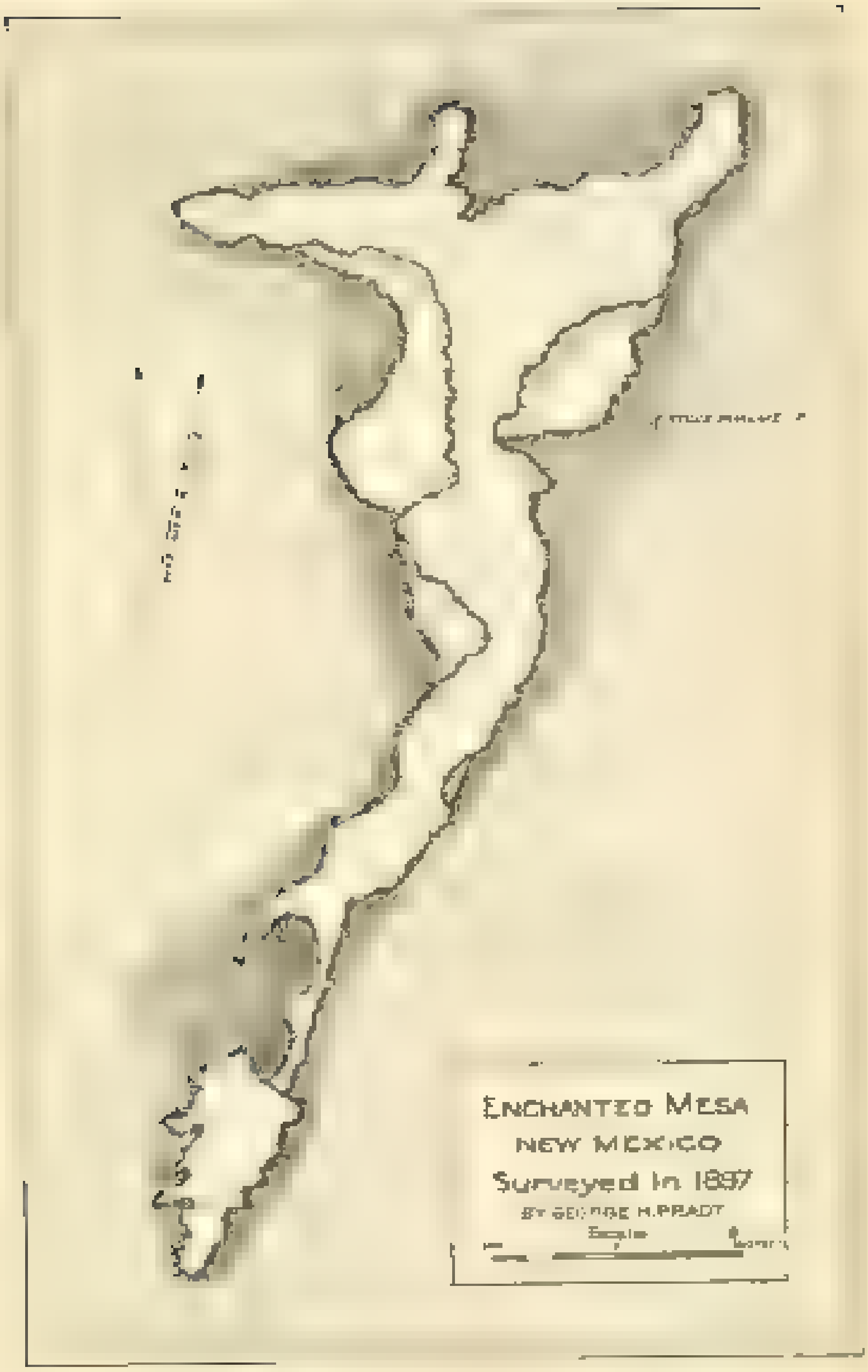
[illegible]

These three [illegible] were [illegible] [illegible]

[illegible] and a medicine priest [illegible] Luis Pino and Santiago Naranjo, [illegible]. After careful inquiry in regard to the information of the former occupancy of Kakabi, I began to [illegible] informed me that "the natives have lived there so long ago that the stories in his country were so distorted so that we could [illegible] hardly expect to find any reliable information of the mesa. When we told him [illegible]

[illegible] other evidences of the only human of these aborigines [illegible] of the present. Accounts to be taken for [illegible]. They evinced much curiosity in the place, and were greatly surprised when we took [illegible] satisfactory explanation. It is needless to say that the natives did not intimate that to a pile we in fact to natural [illegible]

[illegible] of a certain pottery up to contact to the shepd picked up the [illegible] end of a wide stone ax, on the edge of which several small [illegible] time. After descending the mesa the same Indian exhibited [illegible] which was [illegible] similarly to the other. He had found it on the summit or rather on a ledge a few feet below the summit [illegible] the unexplored surrounding charred [illegible] contrast with the white-covered ground [illegible]


ENCHANTED MESA
NEW MEXICO
Surveyed In 1897

[illegible]

[illegible] two hours as long would away, and I was forced to [illegible]

[illegible]

[illegible] to the former institution of the [illegible]

To the Aeon as Kalzino is at [illegible] rated, or I as a [illegible] constituly of angelicism [illegible] must yet regard it [illegible] the

ELECTRIC STREET RAILWAYS

[illegible] 15,250 miles of street-car track in the United States, of [illegible] by cable, and 145 miles, or 1 per cent [illegible] by electricity. The [illegible] cars represented 86 per cent and electric cars seven-tenths of [illegible] by electricity and only seven out of 100 by horses. [illegible]

[illegible] MOVEMENT—AN ERRATUM

[illegible] Wrong titles. They are associated with the wrong titles.

[illegible]

By Gerhard Hermann, L.L.B.,

President of the National Geographic Society,

and Marion Baker,

U. S. Coast and Geodetic Survey

[illegible]

[illegible] than that of Germany and is [illegible] less than that of Europe. [illegible]

[illegible] degrees of longitude, or about one-third of the [illegible] difference. Thus, in midsummer, sunrise [illegible] Monday morning 30 minutes [illegible] sunset in westernmost Alaska [illegible]

[illegible] westward to northernmost Alaska, more than [illegible]

[illegible] feet below sea level in the deserts of southern California to heights of more than [illegible] feet in Alaska.

[illegible]

population of a little less than 4,000,000. A century later its area was nearly eleven times as great and its population almost seventeen times as great, or between 65 and 70 million.

which pointed the way to and stimulated other discoveries. These are at least confined and within the limits of the United States, a tract of land exact which has never been seen by the white man. All other travel, though such and long, merely [illegible] our knowledge of [illegible] and [illegible].

For a century after Cabot's voyage, no advance was made to our [illegible]

[illegible] of the Pacific coast north of California were completely unknown. [illegible] were explored and charted with fabled lands of monsters [illegible]

[illegible] the general outlines of Alaska as we now know them. The pur- [illegible]

[illegible] if not the discoverer of Cook, whom every American student delights to honor, Capt. George Vancouver [illegible]

[illegible] about the production of maps of the revolted colonies. The [illegible] numerous and excellent, for their time, maps by the English [illegible]

[illegible] Georgia, and so much of the interior as was the scene of hostilities [illegible]

[illegible] was very natural. The exploration of the great lakes, of the [illegible] imperfectly known.

Such was the world's geographic knowledge of what is now the [illegible] individual states, private persons, and corporations.

[illegible]

That they might secure to the to land for their homes, the grow-

[illegible] government early devised a system of land partition. Surveyors [illegible] of [illegible] and sale or gift. The land was divided into square [illegible] and sometimes by artificial marks. A row of such towns ran [illegible] from an arbitrary base line. Each town was further subdivided [illegible]

These maps, [illegible] town plats, now constitute a vast body of [illegible]

Land Office now a part of the Department of the Interior

For geographic purposes the results are shown on a series of [illegible] surveys in connection with the topographic surveys [illegible] of the United States.

Coast and Geodetic Survey.—Another old and important geo-[illegible]

I [illegible]

[illegible]

day.

From the very [illegible] lens were high. Great accuracy has ever been aimed at as its motto. It has been a leader and not a follower. It has developed its own spectacles and instruments, and to its officers, civil, military, and naval, we are indebted, [illegible] other things, for the best telescopes for time, for most accurate determinations [illegible]

[illegible]

sounding and the study of the ocean depths.

Its field of work was extended in 1871 to include geodetic work in lieu of other aids in 1879 it received the name of Coast and Geodetic Survey [illegible]

[illegible]

[illegible] physics, terrestrial magnetism, and of the size, shape, and structure of our planet.

Engineer Corps, U. S. A.—The U. S. Engineers, though not now [illegible] only prosecuting geographic research, have in the past made valuable contributions to geography. Prior to and even since the war of the rebellion, 1861–65, numerous expeditions in the far [illegible]

[illegible] two mountain surveys have been carried out to the west by the U. S. Engineers. One was a survey of the northern and northwestern lakes, which after an existence of forty years, was completed in 1881. It has a series of detailed and accurate charts of all the great lakes and will be [illegible]

[illegible] to use in determining certain secular changes to the crust [illegible]

[illegible] compared with recent ones, as at Brest, for a period of [illegible]

[illegible] Introductory address of the Anthropological Association for the Advancement of Science by Mr. G. K. Gilbert, of the U. S. Geological Survey.

Another noteworthy geographic work for the U. S. Army was a general topographic survey in the far west under the [illegible] of Captain George M. Wheeler, U. S. A., and usually referred to as the Wheeler survey. A considerable tract of country was

† [illegible] present Geological Survey in 1879.

[illegible] work of improving rivers and harbors in the interest of commerce is now carried on by the United States Engineers. [illegible] their geographic work, so [illegible] space of surveys for these improvements and of a new survey of the Great Lakes.

Geological Survey.—The chief agency for increasing geographic [illegible]

[illegible] eighteen years old. Nearly or [illegible]

The complexities confronting this survey at its creation of [illegible] an [illegible] be important particular from those similarly confronted by European geological surveys. The [illegible] and, to a slight [illegible] not quite every case, been preceded by topographic surveys, and [illegible]

[illegible]

maps. A [illegible] was given to make [illegible]

Survey has surveyed and mapped on scales of one, two, and four miles to the inch an area of 700,000 square miles, almost equal [illegible]

on the one-mile scale, 60,000 on the two-mile scale, and 60,000 on the [illegible]

state area territory [illegible] these came the geological [illegible]

[illegible]

systematic work [illegible] but on a [illegible] early [illegible] be [illegible] great and

[illegible] work. This has been accomplished and systematic geologic mapping has been in progress for many years.

The aspect of the country and its utility for [illegible] are largely dependent on its mineral resources. It ranges from a very few [illegible] in the driest part of the arid or desert regions of the southwest, to nearly or quite [illegible] feet per year on the coast of Southern Alaska. As the land [illegible] are settled its population [illegible]

[illegible] of the Geological Survey is [illegible]

[illegible] with the water supply in the forestry problem. The proper administration of the forests—their preservation from destruction by [illegible] or [illegible] is a question of [illegible] importance. A number of large forest tracts [illegible] with the Yellowstone National Park, the Yosemite, and others [illegible] of these forest reserves. This work is under the direction of the United States Geological Survey.

The output of the mines and quarries of the United States [illegible] annually a [illegible] of [illegible] has created [illegible] the Geological Survey from the beginning, charged with the duty of [illegible] volume devoted to mineral statistics and the state of the mining industry from year to year. Data permanently recorded in these volumes [illegible] of information useful to those who go directly to the sea to supply [illegible] those of the United States, oceanic meteorology, terrestrial magnetism [illegible]

[illegible] in our knowledge of the geography of the [illegible]

Weather Bureau.—To investigate the history, structure, and [illegible] of the earth's rock-water envelope to the prevention of the [illegible]

[illegible] the behavior and the to be deduced from these laws which furnished to the farmer, the traveler [illegible]

[illegible] It seeks to [illegible] the weather of tomorrow rather than that of the last year or the last century. But, as we are forced to [illegible] not recognized, and within the bureau there has ever been a [illegible]

[illegible] of not stay in for more than we have indicated—so wide, [illegible] lest that time will not permit even a mention of [illegible]

[illegible] we hereby [illegible] and [illegible] the work carried on by the greater geographic agencies of the government of the United States, and yet such summary would be incomplete without mention at least of several other agencies and [illegible] work and activity contributing to a fuller and better knowledge of our geography.

[illegible] total mileage of the United States, as [illegible] measured in [illegible] tracks or stakes, is [illegible] thousand [illegible] 1,[illegible] miles, or about 45 per cent of the world's mileage. To locate and construct these thousands of miles of road, much of it in [illegible] surveys have, too, involved a vast expenditure of money by which geography has knowledge has been increased. It has been estimated, perhaps it would be more exact to say guessed, that [illegible] practical topographic map of the entire country. The total [illegible] statistics. Over all these miles of road have been run [illegible] those obtained from other sources, it has been possible for the [illegible] of the United States [illegible]

[illegible] purposes of the Missouri to be passed at the mouth of the Mississippi or the Gulf of Mexico is 4,200 miles. These two great [illegible], with their tributaries, [illegible] the thousands of miles of navigable [illegible] artery of commerce that [illegible] two [illegible] for the Mississippi and one for the Missouri have established [illegible] [illegible] sheets. Much precise leveling has also been carried on in connection with these surveys.

eral wealth, have conducted geological surveys, or perhaps it should be said geological reconnaissances. Two have conducted [illegible] such states, Rhode Island, Connecticut, and New Jersey, as also [illegible] of one inch to the mile and in contours with a vertical interval of 20 feet.

The Post Office Department, for its own purposes in administering the [illegible] post-offices under its control, compiles state maps showing post-routes and postal divisions. The boun- [illegible] by correspondence and constitute a valuable source of information as to minor boundaries.

A reference has been made to the work of the Fish Commission [illegible] the gentlemen actually conducting the works out, and [illegible] achieved is but a small part of what remains to be done. Geographic research and progress in the United States has never [illegible] promoting geographic research, and the National Geographic Society of Washington [illegible] years [illegible] upon similar work [illegible] have vanished from our maps.

THE U. S. COAST AND GEODETIC SURVEY*

By T. C. Mendenhall, [illegible], [illegible], etc.,

President of the Worcester Polytechnic Institute, and formerly Superintendent of the Coast and Geodetic Survey, Washington, D. C.

OTTO H. TITTMANN,

Assistant in Charge of the Office of the Survey,

While a relatively small part of the energies of the United States Coast and Geodetic Survey has been devoted since the creation of the Bureau in 1807, to geographic exploration [illegible]

[illegible]

From the very start the standard of work has been the highest [illegible]

[illegible] the Survey has made its business to better [illegible]

[illegible]

[illegible] of the Government to which every [illegible] was [illegible]

[illegible] application of science to the solution of certain problems [illegible]

[illegible]

[illegible] ows which carried the wave of commerce to [illegible] with great [illegible]

[illegible]

[illegible] our [illegible] to investigate the tides and currents of the waters which bear these [illegible] burdens of human lives and property [illegible] and to study the mysterious variations in the earth's [illegible]

was largely directed.

[illegible]

In these immediate precursors to Saxton and Ferrel stand Hassler and Bache, the pioneers of Massachusetts and the great chiefs of Hassler and Bache [illegible]

[illegible] ways to. Expert physicists, men as to the utility of the proposed survey had to be trained, and [illegible], men had to be trained to

[illegible] constructed, and correct methods had to be presented. Hassler [illegible] the difficulties presented the necessity and how they were overcome was further a proper subject for study in the history of the Coast Survey which yet remains to be written. It would be a [illegible] history of the progress of science in this country.

It is a fact to be noted that Hassler, in 1844, saw the [illegible] of the [illegible] officers in the volume. His adoption marks the official recognition of the necessity for precise and systematic work in the mapping of our domain. The [illegible] and correct outline of the [illegible]

The extension of the work in a [illegible] connection with the [illegible] of our national domain by acquisition of territory from France, Spain, and Mexico. With the expansion of territory came the extension of the scope of the survey, and finally when it [illegible] a transcontinental transportation [illegible] became important, its protection function was recognized by law.

In accordance with its primary duties the Survey has [illegible] and accurately charted the depths of the waters along our [illegible] coasts, [illegible] all shore [illegible] for the needs of commerce [illegible] and [illegible] the complete survey of the Gulf of Mexico. Long stretches of the Atlantic were [illegible]. Much earlier than those [illegible] stretches, important not alone for their geographic [illegible], but [illegible] developing materials, [illegible] by factors which [illegible] [illegible] success possible. The [illegible] results are [illegible] [illegible] evidence for the [illegible] here.

Its researches in physical hydrography include not only the

ment of planes of reference from which the elevations of the
relations between the ocean level and the land to be inferred
but also valuable for figures of movements of many
shores, as, for instance, those of Cape Cod and of the Japanese
islands of Nippon and Yezo, and brought to discover the fact
that relations between the underlying slow and the surface of the
shores. Here, upon proper work alone is of a national, for
correct conclusions cannot be drawn or profitably applied
[illegible] and of course, labor has been created by no [illegible]

Work of some [illegible] the environment of many special
results, but the discovery of the value of the tidal results are
thoroughly. Coast survey as a factor in [illegible] the depth on
the [illegible] study Hook and the discovery of [illegible] on the
[illegible] and its bearing on the feasibility of obtaining a water
[illegible] as a special [illegible] of property.

As property belonging to the subject of hydrographic [illegible]

are invaluable historical records of the progressive of that coast.
and the same may be said of the volumes containing the numerous [illegible]
[illegible]. They are not intended to [illegible] in general matters, but they
[illegible] shape [illegible] and by [illegible]

The maps of the Survey are published by accurate repre-
[illegible] of [illegible] a narrow frame of topography has been [illegible]
[illegible] triangulation, which in turn rests on a larger framework
of [illegible] which record [illegible] the surveys [illegible] are [illegible]

[illegible] of precise methods for the determination of
latitudes and longitudes were [illegible] with [illegible]
operations of the Survey. Thus the success of Mr. [illegible] the
[illegible] of [illegible] to Walker to propose for
telegraph the longitude determinations [illegible] was not [illegible]
[illegible] 1851, that the [illegible] was successfully [illegible]
tion [illegible] the exact [illegible] between [illegible] and Washington

[illegible] mption, and thereafter the precise determination of longitude [illegible]

As soon as the Atlantic cable had been laid in 1866, the Survey [illegible]

[illegible] for Cambridge, Massachusetts, in 1866, was used. The adopted value (4h 44m 30.5s) had been derived from many [illegible] and chronometer determinations, but they had been increased in 1869 by 3.65s, the result of comparatively brief [illegible] in 1866, as the result of 200 more determinations, was [illegible] of the telegraphic determinations.

[illegible] longitudes of the points [illegible] [illegible]

[illegible] need for some of the prior telegraphic determinations, since the [illegible] in the determination of longitudes. [illegible] however, the geodetic telegraphic, as developed by the Survey, has in the hands of its chief officers been [illegible] of the [illegible] of [illegible].

Reference has been made to the geodetic function of the Survey [illegible] boundary to the Gulf of Mexico. To join this with the primary chain, as yet unconnected, of triangles [illegible] [illegible] the completion of which has been [illegible] recently [illegible]

The [illegible] of [illegible] along this great meridian [illegible] of a [illegible] system of geographic measurements well [illegible] the [illegible] that does for the [illegible] and [illegible] of State surveys for all time to come, if [illegible] permitted to fall into [illegible] to make such an assertion.

THE GEOGRAPHIC WORK OF THE U. S. COAST SURVEY

[illegible] in its inception, [illegible] in its execution, this [illegible]

[illegible]

[illegible] It is hoped will take a hand in the extension northward

[illegible] for its proper operation northward may be extended in the course of time.

[illegible] defining the boundaries of eleven States, and [illegible] has been ex-

[illegible]

[illegible] along the northeastern [illegible] boundary, and in the far north it has

[illegible]

surveys, as well as precise geographic determinations for the British possessions.

[illegible]

early date, and have been continued up to the present time at a

[illegible]

[illegible] brought in regarding magnetic observatory, which it has

[illegible]

[illegible] to investigations at sea and surveys on the land. It [illegible] a basis of reliable information concerning terrestrial magnetism demanded in extent and importance.

[illegible]

years to the study of terrestrial gravity. Beginning with a [illegible]

long [illegible] its observers were quick to detect and [illegible] certain [illegible] and hitherto [illegible] unsuspecting con-

[illegible] subject. Instruments were also improved and modified [illegible]

[illegible] most important [illegible] on several of the [illegible] mountains and [illegible] many islands in the several oceans. No [illegible] was [illegible] a range in longitude. The results of these operations, together with the measurement of the great arc of [illegible] length, form a contribution of no ordinary interest to the [illegible]

[illegible]

By Prof. Willis L. Moore,

Chief of the U. S. Weather Bureau.

The United States Weather Service has been in existence twenty-seven years. During the past twenty-five years local synoptic reports of the service have shown the [illegible] comprehensive atmospheric survey ever presented to the [illegible]

The vast region now brought under the dominion of its daily synchronous observations includes an area extending [illegible] miles north and south, [illegible] miles east and west, and [illegible] fortunately located in the interest of the meteorologist as to cut an important arc from the circumpolar throughfare of storms of the northern hemisphere. The extreme points of observation are Belmont, in the Canadian Province of Assiniboia, on the [illegible] coast, and San Diego, on the southwest; and arrangements are now complete for a co-operation with Mexico similar to that in [illegible] area of observation southward over Mexico and Yucatan.

It is a wonderful panoramic picture of atmospheric condi

[illegible]

[illegible] of [illegible] is shown. Where [illegible] the [illegible] meteorological field [illegible] opportunity to study storms [illegible] place [illegible] necessary.

In [illegible] of the [illegible] [illegible] of storms, early [illegible]

[illegible] Lamb and Ferrel [illegible] adding much to our knowledge; but at the [illegible] one has been able to satisfactorily [illegible] the [illegible]

component of [illegible] to wind [illegible] and accurately computed is the deflection due to the earth's rotation [illegible]

[illegible] to be a slightly higher elevation before condensation [illegible] of the condensation, and [illegible] of the latent heat of [illegible]

The [illegible] defining [illegible], topography, temperature, and [illegible] of the [illegible] on [illegible] give [illegible] when they [illegible] to the physicist to study the [illegible] [illegible] be profitably studied with a [illegible] taken on [illegible] the bottom of the great aerial ocean surrounding the earth.

Here we see [illegible] cyclones formed near the [illegible] [illegible] and waste of the Rocky Mountains [illegible] cyclones

[illegible] assignment to our bases and thence to the St Lawrence valley which on the warmer plains of Colorado, moves into the Ohio [illegible] and evaporates which, if they have their [illegible] at an average altitude of 5,000 feet above sea level and under [illegible] these parts; and finally, they are seen as they reach the [illegible] cross the Pacific ocean come under our [illegible] increases with but [illegible] accumulation of energy sweep across our [illegible] with increasing force and heavy precipitation, and [illegible] sunbeams only to be heard from three days later on [illegible] coasts of northern Europe.

The great anticyclones or high pressure areas, which [illegible] changing conditions during 3,000 miles of their course. The [illegible] north from the cold plains, for a strong vertical and [illegible] from above. In the cold wave [illegible] complete possession of the cold air at the surface from [illegible] compression to its element, it is still far to low the [illegible] temperature at the surface of the earth.

[illegible]

investigation

[illegible]

different classes of atmospheric disturbances. From a knowledge

[illegible]

be count [illegible] [illegible]

Having [illegible] and [illegible], I determined at once, on coming to

[illegible]

of not less than one mile above the earth, as it appeared to

[illegible]

[illegible] necessary to improve our methods of [illegible] observations as a preliminary high-level

method of this important investigation. Professor Marvin was

[illegible]

[illegible] and I am pleased to say that we have [illegible] to such an extent that a wet blanket is now easily sent up to a height of one mile in only a moderate wind. We have

[illegible] that while we [illegible] two [illegible] with recorded temperature, pressure, humidity, and wind velocity. Before next spring we expect to have a [illegible]

[illegible] A further report [illegible] daily reports at an elevation of one [illegible] of water.

We shall soon construct a chart from this [illegible] constantly obtained at these [illegible] stations [illegible] the surface chart made at the same moment. [illegible]

[illegible] of certain of the development of storms and cold waves and eventually improve the forecasts of their future course, extent, and rate of movement.

In exceptional cases we have flown the kites to a height of nearly two miles. From daily readings at only one kite station [illegible] assisted us in estimating the future direction of a storm center when the surface chart gave but negative indications. It will [illegible] tion of storm eddies than heated and ascending convectional currents.

I am anxious to know the difference in temperature between the surface and the upper strata in the different quadrants of the [illegible] when the storm and cold-wave conditions are intense. At an elevation of five miles but little effect remains of diurnal [illegible] give a clue to the future direction of the storm. When we [illegible] be discovered that the storm center at that elevation was not [illegible] center at the surface of the earth. The displacement of this center may possibly give some indication of the future direction of the storm. There are many interesting problems to be solved by this investigation.

The Eleventh International Congress of Orientalists was opened at Paris on September 5, with 300 members in attendance. One of the most [illegible] this are to be completed by the end of [illegible]

GEOGRAPHIC NOTES

AFRICA

[illegible] The first section of the first railway in British West Africa is now being constructed between Freetown and Waterloo.

[illegible] A company has been formed to construct and operate a line of railway from [illegible] to Sabderiya, a distance of about [illegible] miles. A detail is the fact that [illegible] concessionary [illegible]

Abyssinia. A recent report on the trade of Abyssinia states that [illegible], which could have been sold at the rate of a pink for a piastre, which [illegible] prices ranging from [illegible] for the piastre. Quality of [illegible] generally proves well in many parts of the country.

CENTRAL AMERICA

Nicaragua. The report of the government surveyors on the practicability of the proposed railroad from Bluefields to a western frontier of the country in distance of [illegible] miles, the cost of construction at $[illegible], or nearly $[illegible] per mile. It is [illegible] doubtful if the road would pay interest on its proper investment, [illegible] the [illegible] and population [illegible] are now in progress.

[illegible] Mr. Thomas [illegible], U. S. consul at San Juan del Sur, reports in a recent report that there is not [illegible] in that city. As to the high price of wood, although [illegible] is expensive

[illegible]. The [illegible] use of wood [illegible] is very few cases for [illegible] purposes is not due to fear of earthquakes, but to the fact that there is most needed [illegible] clay in the vicinity. There is, however, no market for imported brick.

SOUTH AMERICA

Venezuela. The government of Venezuela has granted to Messrs. Eustace de Beaufort, [illegible] of Amsterdam, the monopoly of all the salt [illegible] in the country, in consideration of the establishment of a new [illegible] in Venezuela with a capital of $[illegible]. The work will have to be [illegible] within [illegible] months, [illegible] the amount of [illegible]. The concession is reported to have created great dissatisfaction among the people.

British Guiana. A recent writer on the gold industry of British Guiana says that while the colony has a future as a gold producing country, its production has not yet removed from the region of doubt. There

[illegible] operations and owners attempting the working of [illegible] constituents [illegible] in the working of the deposits. The total gold production of the colony for the year ending June 30, 1897, was [illegible] ounces, as compared with [illegible] ounces in 1895-96, and [illegible] ounces in 1892-93.

AN IMPROVED METHOD OF KEEPING THE SCORE IN

DUPLICATE WHIST COMPASS WHIST, STRAIGHT WHIST AND EJCHRE.

The one thing needed to perfect the new method has been a convenient device by means of which the score may be on the first round can

Cosmos Duplicate Whist Score

N | E
S | W

HAND	LEASS THIS				HAND
	SCORE	TOTAL	TRUMP	OPPONENTS	
	SCORE	GAIN	TRUMP	GAIN	SCORE
1					1
2					2
3					3
4					4
5					5
6					6
7					7
8					8
9					9
10					10
11					11
12					12
13					13
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16					16
17					17
18					18
19					19
20					20
21					21
22					22
23					23
24					24
Totals					Totals

How a Donkey Found a Mine.

THE history of mine discoveries in the West is full of strange and amusing incidents. Many of the most celebrated mines or lodes have been found by accident. Some of these accidental discoveries are laughable in the extreme. One of them occurred in connection with the discovery of one of the richest mines in the Coeur d'Alene country in Idaho. In this case a common donkey, or jackass, or "burro," as one chooses to term it, was credited with the finding of the mine.

The Northern Pacific Railway's finely illustrated tourist book, **Wonderland '97**, has a chapter on mining in the West, in which the incident alluded to is given. It shows how, from slight or trivial things, great results may flow. There are also articles on **Yellowstone Park, Alaska, Cattle Raising, etc.** By sending Six Cents in postage stamps to CHAS. S. FEE, Gen. Pass. Agent, St. Paul, Minn., any one can obtain a copy of this book. It is full of historical fact and descriptive narrative, and valuable as a school text-book.